18 - EFFECTS OF COMBINED EXERCISE TRAINING IN MORPHOLOGICAL AND NEUROMUSCULAR PARAMETERS OF ELDERLY WOMEN

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INTRODUCTION

Promoting a more active lifestyle of the elderly has been used to promote improvement in health standards, in which physical activity is a strategy to improve the quality of life of the elderly, reducing the deleterious effects of aging (FERREIRA; Ferrreira; MATSUDO; Braggion, 2005).

Muscle strength and power are extremely affected with the aging process, suffering a 60% reduction in 50 years. But the causes of such reduction are not only linked to decreased muscle mass (DIAS; Gurjão; Marucci, 2006).

Body composition refers to the relative percentages of body weight composed of fat and fat-free body tissue. Its evaluation is a common and important component of overall physical fitness assessment, but it is known that excess body fat is harmful to the health (ACSM, 2000). The aging process is accompanied by an increase in body weight, especially from 40 to 60 years old, with a decrease after 70 years of age, body height decreased gradually due to loss of bone mass; increased body fat, reduced fat-free mass and its major components (mineral, water, protein and potassium) decreased resting metabolic rate, skeletal muscle mass and bone mass (MATSUDO; MATSUDO; NETO, 2000).

This muscle wasting condition, called sarcopenia, results in a lower basal metabolic rate, weakness, reduced activity levels, lower bone density and low caloric needs (FOSS; KETEYIAN, 2000).

Falls are responsible for most non-fatal injury in this population and its complications are a major cause of death in people over 65 years of age. Investigating the functionality of lower limbs is of great value to identify patients with risk of falls (Schneider; MARCOLIN; DALACORTE, 2008).

Muscle strength is considered an important component of exercise programs, noting that the benefits of this type of training depends on the combination of the number of repetitions, sets, overload, sequence and intervals between sets and exercises (SILVA; Farinatti, 2007).

Thus, this research verifies the effects of combined exercise training on muscular strength and body composition in elderly women, a subject of great importance, which may contribute to future studies related to exercise on physical fitness and quality of life of the elderly.

METHODOLOGY

This research was characterized as non-randomized clinical trial composed by 63 elderly women, divided into two groups: 40 women for the training group (TG) and 23 for the control group (CG). Sample selection happened in a participatory and voluntary way among the participants. The exclusion criteria for both groups were age lower than 60 years and illness that prevented the participants from performing activities.

Anthropometric measurements, body mass (kg) and height (cm) were obtained according to procedures described by Petroski (2009). For the determination of body mass, a Welmy ® brand scale was used, a stadiometer fixed on the same scale was used to measure height, and for measuring perimetry, a Cardiomed ® brand tape was used. The body mass index (BMI) was obtained by the quotient of body weight / height ², and expressed in kg / m².

The evaluation of upper limb muscle strength was obtained by the bending arm test in 30 seconds and the evaluation of lower limbs muscle strength was obtained by the stand and sit test, in 30 seconds (Rickles; Jones, 2008).

All the component of functional fitness evaluations took place in the same time of day for pre and post tests in both groups, to avoid circadian effects. In addition, all the assessment was administered by the same evaluator / researcher in the Kinanthropometry Laboratory of Faculdade Guairacá (experimental group) and in Paróquia Santos Anjos (control group). Data collection was carried out in two steps: in February (pretest) and in August (posttest) of 2010.

Initially, the testing procedures were demonstrated to the participants, who were instructed to sit on a backless chair side and hold a dumbbell (2.27kg) with the dominant arm, with the initial position of the hand in semi-pronation. After that, the move should consist of full elbow flexion and extension, assuming the supine position of the hand, as frequently as possible, within 30 seconds timed by the evaluator (Polar ® chronometer). There were 2 attempts, with a break of one minute between them, and the largest number of repetitions was considered for the proposed study. The same criteria and the same demonstration and explanation of the tests were exposed to participants, before the pre-tests and the post-tests.

The assessment of lower limb muscle strength was obtained through the stand and sit test, qhich consisted on standing and sitting on a chair, in 30 seconds (Rickles; Jones, 2008). With arms folded and placed on the chest and sitting on a backless chair side and straight-backed (with 43.18 cm seat height) with feet flat on the floor, participants had to perform the complete movement of standing up and sitting down, as frequently as possible, during 30 seconds. For security reasons, the chair was placed against a wall, to prevent its movement during the test. There were 2 attempts, with a break of one minute between them, and the largest number of repetitions was considered for the proposed study. The same criteria and the same demonstration and explanation of the tests were exposed to participants, before the pre-tests and the post-tests.

The experimental group underwent 24 weeks of physical training in machines and free weights (ankle, dumbbells and plates) along with stretching and aerobic dance in the form of circuit. 12 types of resistance exercises were practiced, 6 exercises for lower limbs (horizontal leg press, leg extension, bench flexor, adductor and abductor chair and calf) and 6 for upper limbs (peck deck / flying, seated row, lateral raise, pulley and triceps curl, abdominal and lumbar) involving the major muscle groups and their movements. In addition, we established a weekly frequency of three non-consecutive days and the choice of loads and the intensity was established, following recommendations of the American College of Sports Medicine and the American Hearth Association (2007). Thus, we conducted 72 sessions of physical training in this study.

All sessions of physical training had a duration of 60 minutes for strength, aerobic and stretching training, divided in: 30 minutes of strength training, 20 minutes of aerobic dance and 10 minutes of stretching. For the strength training, each exercise was performed with a number ranging from 0 to 15 repetitions maximum with a regular interval of 1 to 2 minutes between exercises. The control group underwent, once a week (every Friday), with a duration of one hour, stretching training and located work with clubs throughout the 24 weeks, no other activities that interrupt the research being evaluated in the post- test all in the same period of the day.

For statistical analysis we used the software Statistica 6.0. We evaluated the normality of the data and comparison of anthropometric and functional in the pre and post-test ANOVA was used for possible significant differences taking $p \leqslant 0.05$ and to characterize the samples with the tests mean and standard deviation was used the program Excel version 2007 for verification percentile for the presentation of results.

RESULTS AND DISCUSSION

The combined training program was well accepted by participants, with no injuries during the training period. Adherence to training was considered moderate, generally taking the frequency of participants from 60 to 70% of training sessions. Table 1 presents data on body composition of the TG and CG under the conditions pre and post-training.

TABLE 1 - Mean values and standard deviation in body composition variables in pre and post training program.

VARIABLES	TG (n=40) PRÉ (M±DP)	TG (n=40) PÓS (M±DP)	?%	CG (n=23) PRÉ (M±DP)	CG (n=23) PÓS (M±DP)	?%
Weight (kg)	70,5±11,5	70,7±11,1	0,5	70,2±10,8	69,7±10,6	-0,7
BMI (kg/m²)	29,7±4,6	29,8±4,34	0,8	29,8±4,0	29,5±3,9	-0,8
WC (cm)	91,2±9,3	91,7±8,4	0,8	91,6±9,1	89,7±8,7	-1,9
HC (cm)	105,5±9,5	104,5±8,5	-0,7	105,6±8,8	104,8±8,2	-0,6
WHR(cm)	0,87±0,07	0,88±0,05	0,8	0,87±0,04	0,86±0,05	-1,3

Note: TG= Training Group, CG=control group, n=sample, M=Medium, SD=Standard deviation, BMI= body mass, WC=waist circumference, HC=hip circumference, WHR= waist / hip ratio.

There were no significant differences in body composition between the two groups, which maintained BMI values, showing that neither of them decreased lean body mass. However, there was a decrease in the anthropometric measurements of waist, hip and waist-hip ratio for the CG. Waist circumference, in the CG, decreased from 91.6 cm in the pre-test to 89.7 cm in the post-test (-1,9%). Hip circumference was also reduced in TG, decreasing from 105.6 cm to 104.8 cm (-1.3%).

The value of waist/hip ratio had a fall of -1.3% in the CG, which was not significant. Its average was of 0.87cm (pre-test) and 0.86cm (post-test) There was a small increase in the WHR value, in the TG, rising from 0.87cm to 0.88cm. However, it is important to note that there was no decrease in BMI, which slightly increased 0.5%, (from 29.7 kg / m² to 29.8 kg / m²). This small and insignificant increase is supposed to have occurred due to probable lean mass gain, as a result of physical training.

The effects of combined training on the functional fitness components of the participants are described in Table 2 (below). Strength variables values were slightly increased in the lower limbs test for both the CG as for the TG. Strength variables values for upper limbs had significant increase for the TG and small increase for the GC.

TABLE 2- Values, average and standard deviation in strength of upper and lower limbs in pre and post training program.

VARIABLE	TG (n=40) PRÉ (M±DP)	TG (n=40) PÓS (M±DP)	?%	p	CG (n=23) PRÉ (M±DP)	CG (n=23) PÓS (M±DP)	?%	p
LL strength (rep)	14,5±5,1	14,3±3,7	-3,7	0,70	14,9±4,1	15,0 ±4,1	1,3	0,90
UL strength (rep)	18,5±5,8	21,3±4,1	11,0	0,002*	18,4±2,9	19,4±3,2	5,8	0,28

Note: * Significant difference compared to pre-training values ($p \leqslant 0.05$), LL strength – lower limbs strength; UL strength - upper limbs strength; rep-repetitions

The test of the lower limbs strength (sitting or rising from a chair) the TG presented an average of 14.5 repetitions in pre-test and of 14.3 repetitions in post-test, maintaining the same strength capacity during the 24 weeks of combined physical training. For upper limbs test (arm flexion) the pre-training average was of 18.5 repetitions, while the post-training average was of 21.3 repetitions, presenting a significant increase of 11% in the test conducted after the combined training.

For the CG there was improvement in pre and post-training strength in both upper and lower limbs, but not reaching significance, presenting 14,9 repetitions in the pre-test (LL) and 15.0 in the post-test, reaching little difference in the number of repetitions in relation to the TG. For upper limbs, there was also a increased from 18.4 repetitions in the pre-test to 19.4 repetitions in the post-test, deducing that this gain is due to the influence of the located gymnastics and stretching training once a week, or due to environmental factors.

The variables of body composition and physical fitness, achieved improvements in both groups, with significance only in the TG test for upper limbs, thus verifying Andrade and Matsudo (2010) reported in their study on the relationship of explosive strength and muscle power with functional capacity in the aging process, evaluating 227 sedentary women not considering the reference values at 18, which were willing to multi-joint movements by comparing the explosive power and muscle strength of lower limbs of women aged 50 to 79 years and involving these values with functional capacity between them, getting the special strength of impulse without the aid of the arms (EF) and functional capacity and normal walking speed (SPD), time to rise from the chair (CAD), the static equilibrium (EQ) and muscle power (POT) for time jump vertical.O result was lower in the group 70 to 79 years in SPEED AND EQ, concluding that the FE and POT had a lower value when compared to the group of 18 years, thus that the POT does not change because of their age, but the EF showed greater association with functional capacity.

Therefore all studies suggest that progressive strength training with moderate to high intensity can be performed with tolerance in healthy older adults, increasing their strength, regardless their genre. The combination of strength and aerobic training help the elderly prevent several degenerative diseases, and increase the values of several components of physical fitness, with the gradual improvement in aerobic and functional capacity.

CONCLUSION

This study concludes that a program of combined physical training with aerobic and anaerobic activities showed good results in terms of body composition variables in elderly women in both groups studied, contributing to improve body composition, having resisted work, increased muscle strength in both upper limbs (getting significant value) and lower limbs in the TG, contributing to the prevention of various risk factors caused by the decline of age, along with improving other capabilities. Not discarding the improvement of the CG in virtually all variables, serving for future research on environmental factors and sedentary elderly, who may have even greater improvements through prescribed exercises and combined.

REFERENCES

AMERICAM COLLEGE OF SPORTS AND MEDICINE. **American College of Guidelines for Exercise Testing and Prescription.** Traduzido por: ARAÚJO de,Claudio G.S. 5ª Edição. Rio de Janeiro: Revinter, 2000.

AMERICAM COLLEGE OF SPORTS AND MEDICINE. **Physical Activity and Public Health in Older Adults: Recommendation from de American College of Sports Medicine and American Heart Association.** Boston, 2007.

ANDRADE, Rodrigo M.; MATSUDO, Sandra M.M. Relação da Força Explosiva e Potência Muscular com a Capacidade Funcional no Processo de Envelhecimento. **Revista Brasileira de Medicina do Esporte**.São Paulo, v.16, n.5, Setembro/ Outubro de 2010.

DIAS, Raphael M. R.; GURJÃO, André L. D.; MARUCCI, Maria de Fátima N. Benefícios do treinamento com peso para aptidão física de idosos. **Revista ACTA FISIATR**. São Paulo, v.13, n.2, p.90-95, 2006.

FERREIRA, Marcela; MATSUDO, Sandra; MATSUDO, Victor; BRAGGION, Gláucia. Efeitos de um programa de orientação de atividade física e nutricional de mulheres fisicamente ativas de 50 a 72 anos. **Revista Brasileira de Medicina do Esporte.** São Paulo, v.11, n.3, Maio/Junho, 2005.

FOSS, Merle L.; KETEYIAN Steven J. **Fox's Physiological Basics for Exercise and Sport.** Traduzido por: TARANTO, Giuseppe. 6ª Edição. Rio de Janeiro: Guanabara, 2000.

GUIDO, Marcelo; LIMA, Ricardo M.; BENFORD, Ronald; LEITE, Tailce K.M.;PEREIRA, Rinaldo W.; OLIVEIRA, Ricardo J. Efeitos de 24 semanas de Treinamento Resistido sobre Índices da Aptidão Aeróbia de Mulheres Idosas. **Revista Brasileira de Medicina do Esporte.** Brasília, v.16, n.4, Julho/Agosto, 2010.

MATOZO, Adriana Lenart. **Efeito de um Programa de Exercícios Físicos na Força de Membros Superiores e Inferiores em Idosos do Projeto da Academia do Parque do Lago na cidade de Guarapuava- Pr.** Monografia. Guarapuava/PR: Faculdade Guairacá, 2009.

PETROSKI, Edio Luiz. **Antropometria: Técnicas e Padronizações.** 4ª Edição. Porto Alegre: Palloti, 2009.

REBELATTO, José Rubens et al. **Influência de um Programa de Atividade Física de longa duração sobre a força muscular manual e a flexibilidade corporal em mulheres idosas. Revista Brasileira de Fisioterapia**. São Paulo, v.10, n.1, p.127-132, 2006.

RICKLI, Roberta C.; JONES, Jessie C. **Teste de Aptidão Física para Idosos**. Traduzido por : BIDUTTE, Sonia R. C. São Paulo: Manole, 2008.

SHNEIDER, Rodolfo H.; MARCOLIN, Daniel; DALACORTE, Roberta R. Avaliação Funcional em Idosos. **Revista Scientia Medica.** Porto Alegre, v.18, n.1, p.49. Janeiro/Março, 2008

SILVA, Nádia L.; FARINATTI, Paulo T. V. Influência de Variáveis do Treinamento Contra-Resistência sobre a Força Muscular de Idosos: Uma Revisão Sistemática com Ênfase nas Relações Dose-Resposta. **Revista Brasileira de Medicina do Esporte.** Rio deJaneiro, v.13, n.1, Janeiro/Fevereiro, 2007.

SHNEIDER, Rodolfo H.; MARCOLIN, Daniel; DALACORTE, Roberta R. Avaliação Funcional em Idosos. **Revista Scientia Medica**. Porto Alegre, v.18, n.1, p.49. Janeiro/Março, 2008

THOMAS, Jerry R.; NELSON, Jack K. **Research Methods in Physical Activity.** Traduzido por: PETERSEN, Ricardo S. 3ª Edição. Porto Alegre: Artmed, 2002.

TRANCOSO, Ericka S. F.; FARINATTI, Paulo T. V. Efeitos de 12 semanas de Treinamento com Pesos sobre a Força Muscular de Mulheres com mais de 60 Anos de Idade. **Revista Paulista de Educação Física**.São Paulo, v.16, n.2, p.220-229, Julho/Dezembro, 2002.

EFFECTS OF COMBINED EXERCISE TRAINING IN MORPHOLOGICAL AND NEUROMUSCULAR PARAMETERS OF ELDERLY WOMEN

ABSTRACT

The purpose of this study was to investigate the effects of a combined physical training program on body composition and muscle strength in elderly women. This study was characterized as experimental. The study included 61 women, aged between 60 and 80 years, 40 of them belonging to the training group (TG) in Physical Activity Program for Seniors in Guarapuava-Pr, and 23 in the control group.(CG). All participants performed a pre-training evaluation, after which they were subjected to exercise training combined with machines, free weights and aerobics. After 24 weeks they were re-evaluated. The results showed a significant increase in TG in muscle strength of upper limbs (18.5 ± 5.8 to 21.3 ± 4.1), and maintaining muscle strength of lower limbs (14.5 ± 5.1 to 14 , 3 ±3.7). There was also improvement in the the CG, but not significant to upper limb strength (18.4 ± 2.9 to 19.4 ± 3.2) and lower limbs (14.9 ± 4 ,1 to 15.0 ± 4.1), achieving reductions in both combined training program with aerobic activity and anaerobic benefits and provides several positive changes In older women, contributing and helping with a better quality of life, and reflecting on health maintenance and provision of more performing everyday tasks.

KEYWORDS: Physical training, muscle strength and elderly women.

RESUMEN

Le but de cette étude était d'étudier les effets d'un programme d'entraînement physique combinée sur la composition corporelle et la force musculaire chez les femmes âgées. Caractérisé cette étude était de l'expérimental. L'étude a inclus 61 femmes, âgés entre 60 et 80 ans, 40 d'entre eux appartenant au groupe de formation (TG) dans le programme d'activité physique pour les aînés à Guarapuava-Pr. et 23 dans le groupe contrôle. (CG). Effectué tous les participants à l'évaluation de formation pré-, après laquelle ils ont été soumis à un entraînement combinés avec des machines d'exercice, des poids libres et d'aérobic. Après 24 semaines subit une réévaluation post-formation. Les résultats ont montré une augmentation significative des TG de la force musculaire des membres supérieurs (18,5 ± 5,8 à 21,3 ± 4,1), et la force musculaire maintien des membres inférieurs (14,5 ± 5,1 à 14 ans, 3 ± 3,7), et il améliore également la CG, mais significative n'est pas à la force des membres supérieurs (18,4 ± 2,9 à 19,4 ± 3,2) et des membres inférieurs (14,9 ± 4, 1 à 15,0 ± 4,1), b Réductions Atteindre au programme de formation combinée à une activité aérobie et anaérobie et fournit plusieurs avantages des changements positifs dans plus âgés femmes, contributeurs et aider à la meilleure qualité de vie, et de réfléchir sur l'entretien de la santé et la fourniture de plus d'effectuer des tâches quotidiennes.

MOTS-CLÉS: entraînement physique, la force musculaire et les femmes âgées.

RESUMEN

El propósito de este estudio fue investigar los efectos de un programa de entrenamiento combinado físico sobre la composición corporal y la fuerza muscular en mujeres de edad avanzada. Caracteriza este estudio fue el experimental. El estudio incluyó a 61 mujeres, con edades comprendidas entre 60 y 80 años, 40 de ellos pertenecientes al grupo de entrenamiento (TG) en el Programa de Actividad Física para Adultos Mayores en Guarapuava-Pr. y 23 en el grupo control. (CG). Realizado todos los participantes a la evaluación de la formación previa, después de que fueron sometidos a la formación en combinación con máquinas de ejercicios, pesas y ejercicios aeróbicos. Después de 24 semanas se sometieron a re-evaluación posterior a la capacitación. Los resultados mostraron un aumento significativo en la TG de la fuerza muscular de las extremidades superiores (18,5 ± 5,8 a 21,3 ± 4,1), y la fuerza de mantenimiento de los músculos de las extremidades inferiores (14,5 ± 5,1 a 14, 3 ± 3.7), y mejora también el centro de gravedad, pero no de forma significativa a la fuerza de las extremidades superiores (18,4 ± 2,9 a 19,4 ± 3,2) y las extremidades inferiores (14,9 ± 4, 1 a 15,0 ± 4,1), b reducción de lograr en el programa de entrenamiento combinado con la actividad aeróbica y anaeróbica y beneficios proporciona varios cambios positivos en las mayores las mujeres, contribuyendo y ayudando con la mejor calidad de vida, y reflexionar sobre el mantenimiento de la salud y la provisión de más realizar las tareas cotidianas.

PALABRAS-CLAVE: entrenamiento físico, la fuerza muscular y las mujeres de edad avanzada.

EFEITOS DE UM PROGRAMA DE EXERCÍCIOS FÍSICOS COMBINADOS NOS PARÂMETROS MORFOLÓGICOS E NEUROMUSCULAR DE IDOSAS

RESUMO

O objetivo deste estudo para investigar os efeitos combinados do treinamento físico sobre o programa de composição corporal e força muscular em mulheres idosas. Este estudo caracteriza-se como experimental . O estudo incluiu 61 mulheres, com idades entre 60 e 80 anos, 40 deles pertencentes ao grupo treinamento (GT) no programa de atividade física para terceira idade em Guarapuava-Pr. e 23 no grupo controle. (CG). Todos os participantes realizam uma avaliação pré-treinamento, após o que foram submetidos a treinamento físico combinado com máquinas, pesos livres e aeróbica. Após 24 semanas foram submetidos a re-avaliação pós-treinamento. Os resultados mostram aumento da TG de força muscular nos membros superiores significativa de (18,5 ± 5,8-21,3 ± 4,1), e a força muscular dos membros inferiores manutenção (14,5 ± 5,1 para 14, 3 ± 3,7), e ali, mas também melhorar a CG significativamente a força dos membros superiores não (18,4 ± 2,9-19,4 ± 3,2) e membros inferiores (14,9 ± 4, 1 a 15,0 ± 4,1), reduções na alínea b combinado com o programa de treinamento aeróbio e anaeróbio atividade proporciona vários benefícios e Alterações nas mais positivos mulheres, contribuindo e ajudando com uma melhor qualidade de vida, e refletir sobre a manutenção da saúde e prestação de mais realizar as tarefas diárias.

PALAVRAS-CHAVE: Treinamento físico, força muscular e mulheres idosas.